Quantum with Unity Pro
140 MSB 101 00 /
140 MSC 101 00
Single Axis Motion Modules
User Manual

September 2004

33002495 01

a brand of Schneider Electric

Telemecanique

Table of Contents

Safety Information 5

About the Book 7

Part I Functional Overview 9
At a Glance 9

Chapter 1 Overview 11
Overview 11

Chapter 2 Specifications and Hardware Overview 13
140 MSB 101 00 and 140 MSC 101 00 Modules 13

Chapter 3 System Information 17
At a Glance 17
Flash Memory 18
Communications Protocol 19
On-line and Off-line Development with MMDS 20

Part II Module Description 21
At a Glance 21

Chapter 4 140 MSx 101 00: Single Axis Motion Module 23
Overview 23
Quantum Single Axis Motion (MSx) Modules 24
Front Panel Indicators for the 140 MSx 101 00. 25
Front Panel Connectors 27
Rear Panel Switches. 30
Operational Specifications. 31
Electrical Specifications. 34
Parts List 37

Chapter 5 Connection accessories 39
Overview 39
The Breakout Module 690 MCB 000 00 40
Breakout Module Cover 690 MCB 101 00 43

Part III Configuration 45
At a Glance 45

Chapter 6 Quantum Addressing Modes 47
Overview 47
Flat Addressing—Modicon Quantum 800 Series I/O Modules 48
Topological Addressing—Modicon Quantum 800 Series I/O Modules with Unity 49
Addressing Example 50
Discrete I/O Bit Numbering 51
Addressing 52

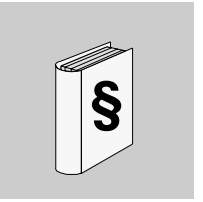
Chapter 7 IO Mapping Configuration 53
Parameter Configuration 53

Chapter 8 Hardware Installation 55
At a Glance 55
Mounting and Connecting the MSx Modules 56
Conforming to European CE Approval Standards 61

Chapter 9 Setting the Rear Panel Switches 63
Overview 63
Setting the Operating Mode with SW1 64
Setting Modbus Comm Characteristics with SW2 65

Index 67

Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death, serious injury, or equipment damage.

WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

CAUTION

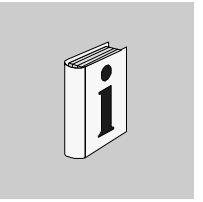
CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

PLEASE NOTE

Electrical equipment should be serviced only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained persons.

© 2004 Schneider Electric. All Rights Reserved.

About the Book



At a Glance

Document Scope

This documentation describes the functionality of the Quantum Automation Series single axis motion (MSx) modules (140 MSB 101 00 and 140 MSC 101 00).
This documentation is valid for Unity Pro from version 2.0.

Validity Note

The data and illustrations found in this documentation are not binding. We reserve the right to modify our products in line with our policy of continuous product development. The information in this document is subject to change without notice and should not be construed as a commitment by Schneider Electric.

Related Documents

Title of Documentation	Reference Number
Quantum Hardware Reference Manual	UNYUSE10010V20E
Quantum Discrete and Analog I/O Reference Manual	UNYUSE10010V20E
Quantum Experts and Communication Reference Manual	UNYUSE10010V20E
Grounding and Electromagnetic Compatibility of PLC Systems User Manual	UNYUSE10010V20E
Quantum and Premium Communication Architecture Reference Manual	UNYUSE10410V20E
Single Axis Software System (SASS) Motion User Guide	
Modicon Motion Development Software (MMDS) User Guide	
Lexium 17D Series Servo Drive User Guide	890USE12000

Note: The above mentioned documentations are only available in online form at this time.

Product Related Warnings

Schneider Electric assumes no responsibility for any errors that may appear in this document. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

No part of this document may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without express written permission of Schneider Electric.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When controllers are used for applications with technical safety requirements, please follow the relevant instructions.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this product related warning can result in injury or equipment damage.

User Comments

We welcome your comments about this document. You can reach us by e-mail at TECHCOMM@modicon.com

Functional Overview

I

At a Glance

Introduction

This part describes the functional overview of the single axis motion modules (140 MSB 101 00 and 140 MSC 101 00).

What's in this Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
1	Overview	11
2	Specifications and Hardware Overview	13
3	System Information	17

Overview

1

Overview

Single Axis Motion Modules

The Quantum Automation Series single axis motion (MSx) modules (140 MSB 101 00 and 140 MSC 101 00) are designed to control a single axis of motion using advanced digital brushless motion control. This capability provides optimal control by eliminating potentiometer adjustments and analog velocity loops. The MSx modules are designed to interface directly to the Schneider Electric Lexium 17D series brushless servo amplifiers as well as other types of dc and brushless drives.

Note: These modules are designed to serve your many and varied applications with great accuracy and speed. However, certain applications might be outside the scope of this module. Please consult Schneider Electric for applications information if you intend to use the module specifically for precise velocity control.

The primary feedback used by the direct numeric processing (DNP) servo system is position information from either a resolver or an encoder mounted to the motor. Velocity information is derived from the position information, rather than being received from a velocity transducer. This leads to some inaccuracies when using the DNP servo as a velocity controller. Small speed irregularities may result, particularly at slower speeds.

System Configuration

The Quantum single axis motion (MSx) modules are incremental encoder (140 MSB 101 00) or resolver and encoder (140 MSC 101 00) feedback-only modules contained in a single-width housing. It works with servo motors that use Lexium drives and other types of DC and brushless drives from other manufacturers.

Specifications and Hardware Overview

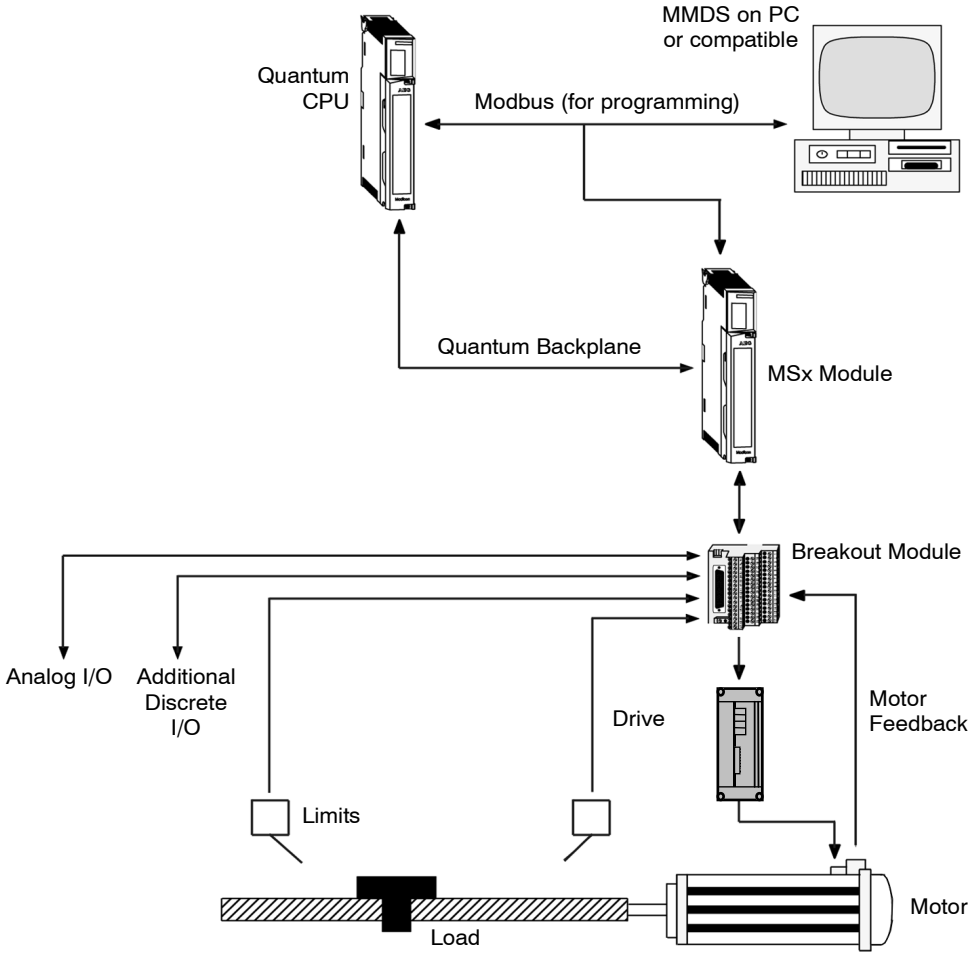
2

140 MSB 101 00 and 140 MSC 101 00 Modules

MSx Modules

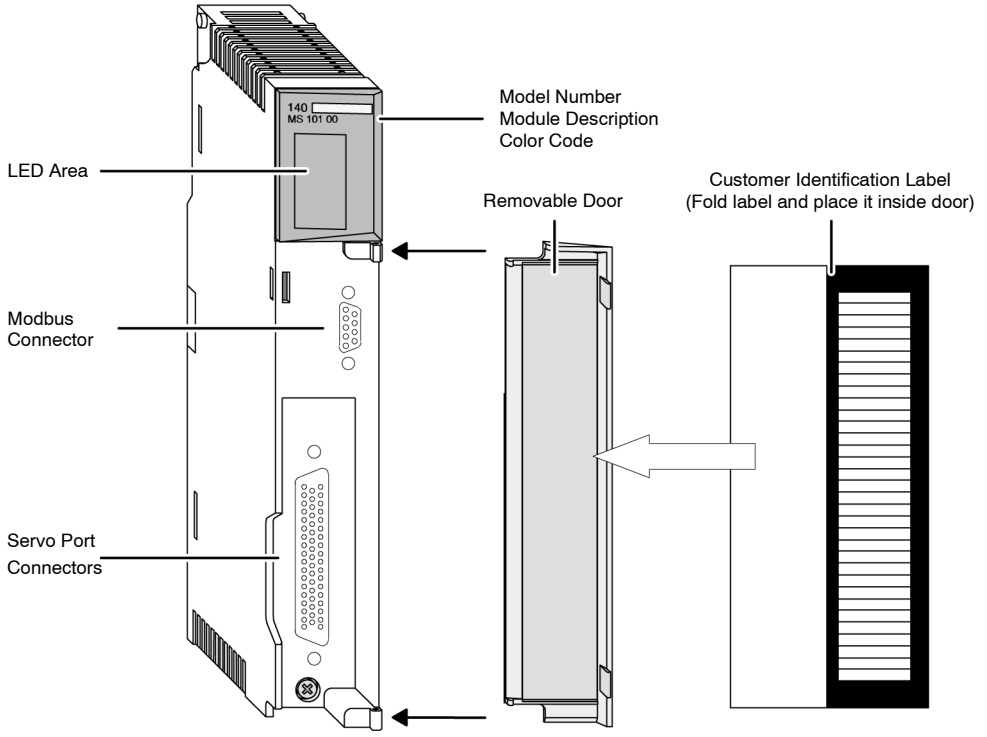
The Quantum single axis motion (MSx) modules are incremental encoder (140 MSB 101 00) or resolver and encoder (140 MSC 101 00) feedback-only modules contained in a single-width housing. It works with servo motors that use Cyberline drives and other types of DC and brushless drives from other manufacturers.

The illustration below shows a typical configuration of a single axis motion control system



The modules contain I/O to interface to the drive and the machine, including drive enable, drive fault, and a variety of user-configurable signals. The modules also include a high speed input pin to perform high speed position capture

See the illustration of a Quantum MSx module below.



Note: MSx modules are only installed in Quantum backplanes. Refer to the Quantum Automation Series Hardware Reference Guide for detailed specifications of all Quantum modules and associated hardware. (Reference No. see *Related Documents, p. 8*).

System Information

3

At a Glance

Purpose

This Chapter provides system information on Flash Memory, Communications Protocol, and On-line and Off-line Development with MMDS.

Note: Refer to Appendix E in the *Single Axis Software System (SASS) Motion User Guide* for system checkout information.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Flash Memory	18
Communications Protocol	19
On-line and Off-line Development with MMDS	20

Flash Memory

Flash EEPROM

The MSx comes with a flash EEPROM that allows storage of application programs and configuration parameters such as servo parameters, speed limits, etc. The flash also accepts firmware updates as firmware enhancements become available.

Communications Protocol

Backplane Communications

Backplane communications with the MSx is through six 3x and 4x registers, which must be I/O mapped to the MSx. Modbus communication with the MSx is through six pairs of registers via the Modbus communication link. The register format is very rigid. The first register sent to the module (4X)is always the control register, and the second is always the command register. The first register returned from the module (3X) is always the current status of the module, while the second register returned is always an echo of the command register. All remaining registers, data register 1 ... 4, are reserved for data and are used as necessary. For additional information refer to Single Axis Software System (SASS) Motion User Guide.

On-line and Off-line Development with MMDS

MMDS

The Modicon Motion Development Software (MMDS), Version 4.1 or higher, is an on-line/off-line software package which runs on a user-supplied IBM PC or compatible computer. MMDS is purchased separately. The computer with MMDS can be connected to the MSx through an RS-232 serial interface.
With MMDS, you can set parameters, check module diagnostics, and exercise the motor during initial system setup. You can also write motion programs and download them into the MSx directly.

Note: If the module is I/O mapped in a Quantum PLC and the user has a Modbus Plus adaptor card in their PC, it is possible to do on˜line development over the Modbus Plus network. Refer to the Modicon Motion Development Software (MMDS) User Guide for details.

Module Description

II

At a Glance

Introduction

The following part provides information on the Quantum Automation Series Single Motion (MSx) Modules, related Hardware and Specifications.

What's in this Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
4	140 MSx 101 00: Single Axis Motion Module	23
5	Connection accessories	39

140 MSx 101 00: Single Axis Motion Module

4

Overview

Purpose

The following chapter provides information of the Quantum 140 MSx 101 00 module.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Quantum Single Axis Motion (MSx) Modules	24
Front Panel Indicators for the 140 MSx 101 00	25
Front Panel Connectors	27
Rear Panel Switches	30
Operational Specifications	31
Electrical Specifications	34
Parts List	37

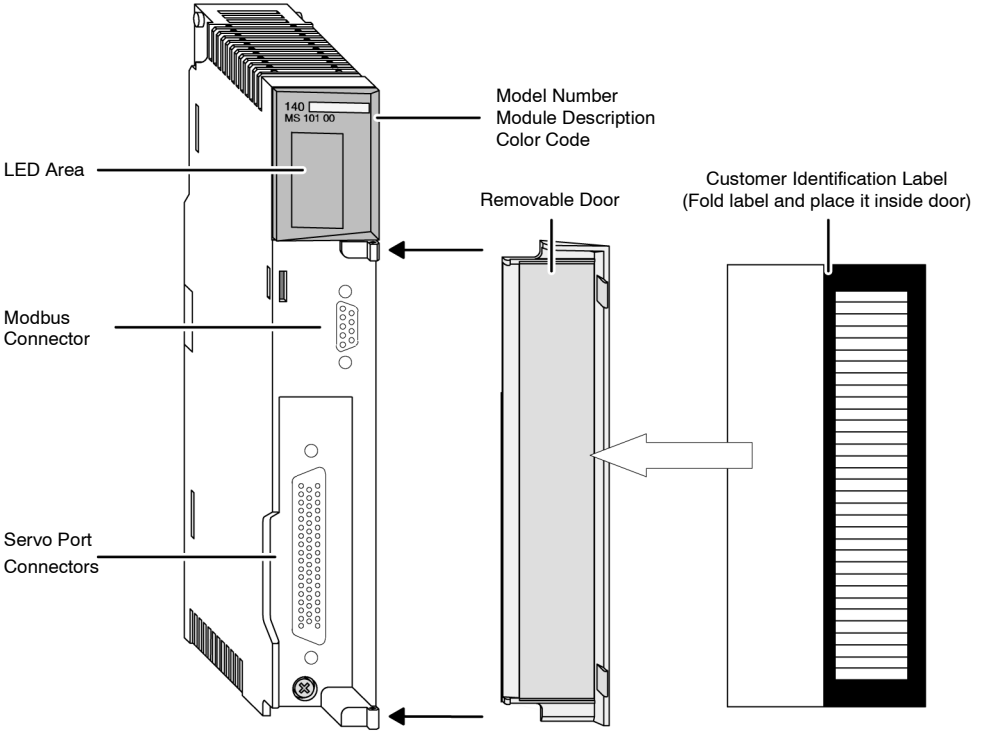
Quantum Single Axis Motion (MSx) Modules

Function

The Quantum single axis motion (MSx) modules are incremental encoder (140 MSB 101 00) or resolver and encoder (140 MSC 101 00) feedback-only modules contained in a single-width housing. It works with servo motors that use Lexium drives and other types of DC and brushless drives from other manufacturers.

Illustration

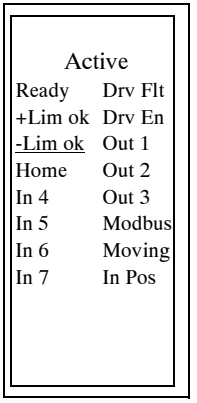
The following figure shows the 140 MSx 101 00 module and its components.



Front Panel Indicators for the 140 MSx 101 00

LED Indicators Panel

The following illustration represents the LED Indicators Panel.



LED Indicators and Descriptions

There are seventeen LED indicators visible on the front panel:

LEDs	Color	Indication when On
Active	Green	Bus communication is present.
Ready	Green	The module has passed powerup diagnostics
+Lim ok	Green	Digital Input 1 active
-Lim ok	Green	Digital Input 2 active
Home	Green	Digital Input 3 active
In 4	Green	Digital Input 4 active
In 5	Green	Digital Input 5 active
In 6	Green	Digital Input 6 active
In 7	Green	Digital Input 7 active
Drv Flt	Red	Fault signal from drive
Drv En	Green	Drive enabled
Out 1	Green	Digital Output 1 active
Out 2	Green	Digital Output 2 active
Out 3	Green	Digital Output 3 active
Modbus	Green	Communications are active on the Modbus port
Moving	Amber	Motor is moving
In Pos	Amber	Motion is within the in position of the final target

Front Panel Connectors

General

There are two connectors located on the front of the Module.

- A SUB-D 9 connector for RS232 Modbus link
- A SUB-D 50 port for connection to the servo drive.

Modbus Connector

The following table shows the Modbus port pinout connectors.

PIN	Signal	Function
1		Shield
2	TXD	Serial data
3	RXD	Serial data
4	GND	Ground
5	DTR	Control Line
6	DSR	Control Line
7	RTS	Control Line
8	CTS	Control Line

Servo Connector

The following table shows the Servo Connector Signals 34 trough 50.

PIN	Signals 140 MSB 101 00	Signals 140 MSC 101 00
34	Velocity+	Phase A
35	N/C	Phase B
36	N/C	Phase C
37	Velocity-/Phase common	Velocity-/Phase common
38	Drive fault	Drive fault
39	Drive enable contact (NO)	Drive enable contact (NO)
40	Drive enable contact N/C	Drive enable contact N/C
41	Drive enable common	Drive enable common
42	Overtemp high	Overtemp high
43	Overtemp low	Overtemp low
44	Cosine input high	Cosine input high
45	Cosine input low	Cosine input low
46	Sine input high	Sine input high
47	N/C	Sine input low
48	N/C	Reference output high
49	N/C	Reference output low
50	N/C	N/C

The following table shows the Servo Connector Signals 18 trough 33.

PIN	Signals 140 MSB 101 00	Signals 140 MSC 101 00
18	24 VDC	24 VDC
19	24 V common	24 V common
20	Brake output (Auxiliary output 1)	Brake output (Auxiliary output 1)
21	Auxiliary output 2	Auxiliary output 2
22	Auxiliary output 3	Auxiliary output 3
23	Limit CW (Auxiliary input 1)	Limit CW (Auxiliary input 1)
24	Limit CCW (Auxiliary input 2)	Limit CCW (Auxiliary input 2)
25	Home (Auxiliary input 3)	Home (Auxiliary input 3)
26	Auxiliary input 4	Auxiliary input 4
27	Auxiliary input 5	Auxiliary input 5
28	Auxiliary input 6	Auxiliary input 6
29	Auxiliary input 7	Auxiliary input 7
30	High speed input	High speed input
31	Analog output	Analog output
32	Analog common	Analog common
33	Analog input	Analog input

The following table shows the Servo Connector Signals 1 trough 17.

PIN	Signals 140 MSB 101 00	Signals 140 MSC 101 00
1	Encoder 1 Phase A+	Encoder 1 Phase A+
2	Encoder 1 Phase A-	Encoder 1 Phase A-
3	Encoder 1 Phase B+	Encoder 1 Phase B+
4	Encoder 1 Phase B-	Encoder 1 Phase B-
5	Encoder 1 Mark+	Encoder 1 Mark+
6	Encoder 1 Mark-	Encoder 1 Mark-
7	Encoder 2 Phase A+	Encoder 2 Phase A+
8	Encoder 2 Phase A-	Encoder 2 Phase A-
9	Encoder 2 Phase B+	Encoder 2 Phase B+
10	Encoder 2 Phase B-	Encoder 2 Phase B-
11	Encoder 2 Mark+	Encoder 2 Mark+
12	Encoder 2 Mark-	Encoder 2 Mark-
13	N/C	N/C
14	N/C	N/C
15	N/C	N/C
16	N/C	N/C
17	N/C (Not connected)	N/C (Not connected)

Rear Panel Switches

Introduction

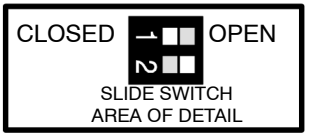
The MSx has an RS-232 serial port to connect the module to an IBM PC (or compatible) running the Modicon Motion Development Software (MMDS). A two-position DIP switch is located on the rear panel of the module (below).

- SW1 is used to specify the module's operating mode (984 or MMDS control).
- SW2 is used to specify the communication characteristics of the Modbus port upon power-up.

Note: SW1 and SW2 are open when they are switched away from the internal PCB of the module.

Illustration

The following figure shows the two-position DIP switch.



Description

The following table shows the settings and functions for DIP Switches.

Switch	Setting	Function
SW1	*Closed	MMDS control
	Open	PLC control
SW2	Closed	Programmed baud
	*Open	Modbus default
*Factory setting		

Operational Specifications

Servo

Specifications

Commutation Update Row	0.25 ms
Velocity Loop Update Rate	0.5 ms
Velocity Loop Bandwidth	> 100 Hz
Velocity Range	0 – 6000 rpm
Position Loop Update rate	1 ms
Position Accuracy – Resolver	10 arc minutes typical, 15 arc minutes max
Position Repeatability – Resolver	5 arc minutes max
Position Accuracy – Encoder	Encoder dependent, 0.5 arc minutes max

Communication

Specifications

Protocol	Modbus
Address (set by software)	1 default
Baud Rate (set by software)	300 – 19200 baud, 9600 default

Application Program

Specifications

Execution Rate	See note below
Storage	650 instructions

Note: A majority of the instructions typically take 1 ms to execute. The execution time of an instruction, though, is not constant. The execution time can increase due to factors such as: if the Sync Ratio Mode is on, how often the position generator must execute to plan out new moves, how many whenevers are enabled, the number of sources requesting commands be executed (e.g., backplane, internal program, Modbus port), etc. If timing is extremely critical to an application, actual time must be determined experimentally by running the actual application program.

High Speed Input

Specifications

Position Capture Time	250 ms max
Isolation	500 V to system bus
Pulse Width	25 ms
Minimum Time Between Successive Captures	20 ms

Discrete Inputs

Specifications

Number	7
Scan Time	1.5 ms
Isolation	500 V to system bus

Discrete Outputs

Specifications

Number	3
Update Time	10 ms max
Isolation	500 V to system bus
Reset State	0 V, nominal
On State	24 V, nominal
Output Type	Totem pole (sink/source)
Protection	Short circuit, overvoltage
Fault	Overcurrent detected

Analog Input

Specifications

Number	1
Scan Time	15 ms
Data	User configurable
Range	10 V
Accuracy	100mV, plus offset

Analog Output

Specifications

Number	1
Scan Time	20 ms
Data	User Configurable
Range	10V
Accuracy	50 mV, plus offset

Resolver feedback (Fully Configured Version)

Specifications

Conversion Method	Tracking
Resolver Style	Transmit
Excitation Frequency	5 kHz
Excitation Amplitude	Automatically adjusted
Excitation Current	120 mA
Loss of Feedback	Detected within 40 ms

Incremental Encoder Feedback

Specifications

Resolution	4 times line count
Signals	A, B, Mark
Signal Frequency	200 kHz, up to 500 kHz with reduced noise immunity
Encoder Output style	Differential, 5 V
Loss of Feedback	Detected within 40 ms

Electrical Specifications

Discrete Inputs and HIgh Speed Input

Specifications

Input Impedance	3.5 kΩ
Inputs On	15 Vdc min
Inputs Off	5 Vdc max
Isolation	500 Vac to system bus

Discrete Output

Specifications

Drive Capability	150 mA at user supplied 19.2 ... 30 Vdc resistive
Protection	Current limit, thermal
Isolation	500 Vac to system bus

Analog Input

Specifications

Resolution	10 bits
Input Impedance	30 kΩ
Offset	50 mV
Accuracy	100 mV, plus offset

Analog Output

Specifications

Resolution	12 bits
Drive Capability	3 mA
Offset	50 mV
Accuracy	50 mV, plus offset

Resolver Interface

Specifications

Reference	5 0.05 kHz 1.6 ... 5.5 v rms 50 mA drive capability
Sine/Cosine Input Impedance	3 kΩ
Resolution	16 bits to 300 rpm 14 bits to 1350 rpm 12 bits to 6000 rpm
Accuracy	10 arc minutes, typical, resolver dependent

Motor Temperature Input

Specifications

Normal State	Short circuit, 2 mA sink max
Fault State	Open circuit
Isolation	500 Vac to system bus

Encoder Feedback Interface

Specifications

Input Range	-0.7 ... 7Vdc
Input Impedance	145Ω, nominal
Differential Signals, HIgh	+2 V differential, min
Differential Signals, Low	-2 V differential, min
Maximum Encoder Frequency	200 kHz square wave (55% ... 45% with less than 15° of quadrature error)
Isolation	500 Vac to system bus with external power supply
Minimum Encoder Pulse Width	1 ms

Drive Interface

Specifications

Drive Fault Input	True high, TTL compatible relative to 10K internal pull-up resistor
Drive Enable Relay	Form C contacts 120 Vac@0.1A resistive 30 Vdc@0.5A resistive
Current Command Voltages	10 Vdc
Current Command Summing Accuracy	0 0.1 Vdc
Current Commands	3 mA drive capability

Power Requirements

Specifications

Main Power Input	5 V 5% @750 mA (with no encoders or resolvers attached, output off)
Main Power Input	5 V 5% @1000 mA (with maximum encoder and resolver load, outputs on)
Hot Swap Surge Current	Less than 5 A

Parts List

Parts List

Parts List

Part Number	Description
140 MSB 101 00	Quantum Motion Module
140 MSC 101 00	Quantum Motion Module
690 MCB 000 00	Breakout Module, 50 Signal
690 MCB 101 00	CE Compliant Breakout Module Cover
690 MCI 000 01	Low profile DB50/DB50 cable, 1 ft
690 MCI 000 03	Low profile DB50/DB50 cable, 3 ft
690 MCI 000 06	Low profile DB50/DB50 cable, 6 ft

Connection accessories

5

Overview

Purpose

The following chapter provides information of the connection accessories for the 140 MSx 101 00 module.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
The Breakout Module 690 MCB 000 00	40
Breakout Module Cover 690 MCB 101 00	43

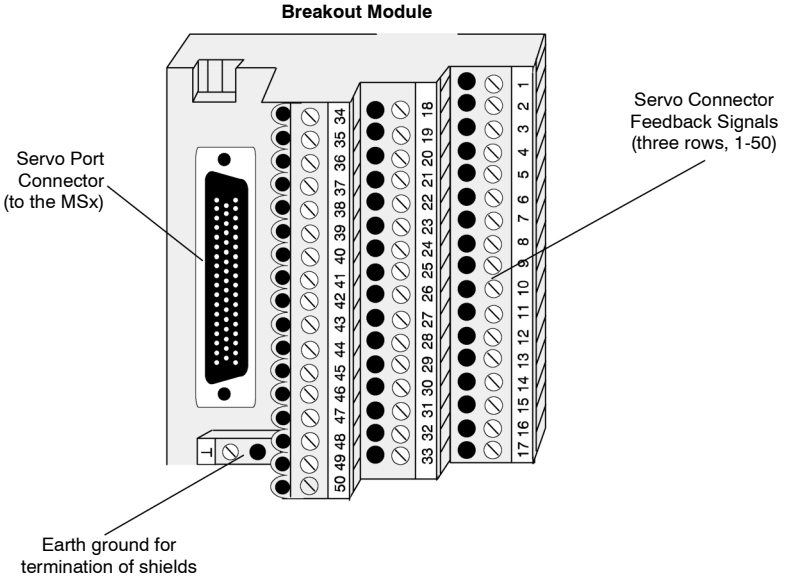
The Breakout Module 690 MCB 000 00

Breakout Module

The Breakout Module (see below) is the I/O wiring block connector for the 140 MSx 101 00 Single Axis Motion Module servo connections. It is connected to the MSx via a Breakout Module cable (690 MCI 000 xx) at the 50-pin servo connector.

Illustration

The following figure shows the Breakout Module, with its Earth ground and Servo Port Connectors.


Breakout Module
Servo Port Connector (to the MSx)
Servo Connector Feedback Signals (three rows, 1-50)
Earth ground for termination of shields
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

Reference Labels

Provided with the Breakout Module are labels for the MSB and MSC modules. These labels are a reference for the Breakout Module signal names. Attach the applicable label near this Breakout Module in your cabinet or rack.

Reference Label for the MSB

The following figure represents the reference label for the MSB Breakout Module connection names.

Modicon 140 MSB 101 00 Connections

1	CH2 A+	18	24 VDC	34	VEL+
2	CH2 A-	19	24 Com	35	N/C
3	CH2 B+	20	Brake	36	N/C
4	CH2 B-	21	OUT 2	37	VEL-
5	CH2 M+	22	OUT 3	38	Drv Fit
6	CH2 M-	23	CW Lim	39	EN NO
7	CH3 A+	24	CCW Lim	40	EN NC
8	CH3 A-	25	Home	41	EN Com
9	CH3 B+	26	IN 4	42	OTemp+
10	CH3 B-	27	IN 5	43	OTemp-
11	CH3 M+	28	IN 6	44	N/C
12	CH3 M-	29	IN 7	45	N/C
13	N/C	30	HSI	46	
14		31		47	N/C
15	N/C	32	AN Com	48	
16		33		49	N/C
17	N/C				

Reference Label for the MSC

The following figure represents the reference label for the MSC Breakout Module connection names.

Modicon 140 MSC 101 00 Connections

1	CH2 A+	18	24 VDC	34	∅A
2	CH2 A-	19	24 Com	35	∅B
3	CH2 B+	20	Brake	36	∅C
4	CH2 B-	21	OUT 2	37	∅COM
5	CH2 M+	22	OUT 3	38	Drv Fit
6	CH2 M-	23	CW Lim	39	EN NO
7	CH3 A+	24	CCW Lim	40	EN NC
8	CH3 A-	25	Home	41	EN Com
9	CH3 B+	26	IN 4	42	OTemp+
10	CH3 B-	27	IN 5	43	OTemp-
11	CH3 M+	28	IN 6	44	COS+
12	CH3 M-	29	IN 7	45	COS-
13	N/C	30	HSI	46	SIN+
14	N/C	31	AN OUT	47	SIN-
15	N/C	32	AN Com	48	REF+
16	N/C	33	AN IN	49	REF-
17	N/C			50	N/C

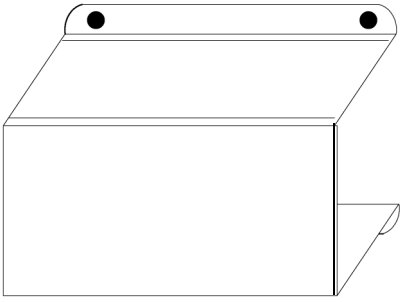
Wiring Information

Refer to the Lexium 17D User's Guide, Appendix C, Drive-to-Controller Wiring Diagrams to obtain cabling informations.

Breakout Module Cover 690 MCB 101 00

Breakout Module Cover

A Breakout Module cover (below), Modicon # 690 MCB 101 00, is also available, which shields the termination points of the breakout module from electrostatic discharge. It is a metal plate that is screwed down to the same panel as the DIN rail that holds the Breakout Module. This cover is required to make the system CE* compliant (refer to *Mounting and Connecting the MSx Modules, p. 56* for installation instructions).
The Breakout Module cover protects against electrostatic discharge.



* The CE mark indicates compliance with the European Directive on Electromagnetic Compatibility (EMC) (89/336/EEC). In order to maintain compliance, the Quantum system must be installed per the installation instructions.

Configuration

III

At a Glance

Introduction

The following part provides information about the configuration of the 140 MSx 101 00 module.

What's in this Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
6	Quantum Addressing Modes	47
7	IO Mapping Configuration	53
8	Hardware Installation	55
9	Setting the Rear Panel Switches	63

Quantum Addressing Modes

6

Overview

Purpose

In the functional description of this Expert Module the register addressing (3x, 4x) established in the Quantum world is widely used. To allow the user an easy transition to the addressing modes provided by Unity Pro, this chapter describes the different modes Unity Pro allows to address the data from a Quantum module:

- Flat Addressing
- Topological Addressing

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Flat Addressing—Modicon Quantum 800 Series I/O Modules	48
Topological Addressing—Modicon Quantum 800 Series I/O Modules with Unity	49
Addressing Example	50
Discrete I/O Bit Numbering	51
Addressing	52

Flat Addressing—Modicon Quantum 800 Series I/O Modules

Introduction

The Modicon Quantum with Unity modules follow a system of flat address mapping. To work properly. each module requires a determinate number of bits and/or words. The IEC addressing system is equivalent to the 984LL register addressing. Use the following assignments:

- 0x is now %Mx
- 1x is now %Ix
- 3x is now %IWx
- 4x is now %MWx

Use the following table to convert 984LL notation to IEC notation.

Outputs and Inputs	984LL Notation Register Addresses	IEC Notation		
		System Bits and Words	Memory Addresses	I/O Addresses
output	0x	System Bit	%Mx	%Qx
input	1x	System Bit	%Ix	%Ix
input	3x	System Word	%IWx	%IWx
output	4x	System Word	%MWx	%QWx

To access the I/O data of a module,

Step	Action
1	Enter the address range in the configuration screen.

Examples

The following examples show the relationship between 984LL register addressing and IEC addressing:
000001 is now %M1
100101 is now %I101
301024 is now %IW1024
400010 is now %MW10

Topological Addressing—Modicon Quantum 800 Series I/O Modules with Unity

Introduction

Use topological addressing to access I/O data items. Identify the topological location of the module within a Modicon Quantum with Unity system using the following notation:

```
%<Exchangetype><Objecttype>[\b.e\]r.m.c[.rank]
```

Abbreviations used:

- **b** = bus
- **e** = equipment (drop)
- **r** = rack
- **m** = module slot
- **c** = channel

Note: When addressing,

1. The [\b.e\] defaults to \1.1\ in a local rack and does not need to be specified.
2. The rank is an index used to identify different properties of an object with the same data type (value, warning level, error level).
3. The rank numbering is zero-based, and if the rank is zero, omit the entry.

For detailed information on I/O variables, please refer to the *Unity Pro Reference Manual*.

Example

Reading Values

To read	Action
input value (rank = 0) from channel 7 of an analog module located in slot 6 of a local rack:	Enter `%IW1.6.7[.0]`
input value (rank = 0) from channel 7 of an analog module located in drop 3 of RIO bus 2:	Enter `%IW\2.3\1.6.7[.0]`
'out of range' value (rank = 1) from channel 7 of an analog module located in slot 6 of a local rack:	Enter `%I1.6.7.1[.0]`

Addressing Example

Example for the 3 Addressing Modes

The following example compares the 3 possible addressing modes. An 8-channel thermocouple 140 ATI 030 00 module with the following configuration data is used:

- mounted in slot 5 of the CPU rack (local rack)
- starting input address is 201 (input word %IW201)
- end input address is 210 (input word %IW210)

To access the I/O data from the module you can use the following syntax:

Module data	Flat addressing	Topological addressing	IODDT addressing	Concept addressing
Channel 3 temperature	%IW203	%IW1.5.3	My_Temp.VALUE	300203
Channel 3 out of range	%IW209.5	%I1.5.3.1	My_Temp.ERROR	300209 Bit 5 to be extracted by user-logic
Channel 3 range warning	%IW209.13	%I1.5.3.2	My_Temp.WARNING	300209 Bit 13 to be extracted by user-logic
Module internal temperature	%IW210	%IW1.5.10	not accessible through IODDT	300210

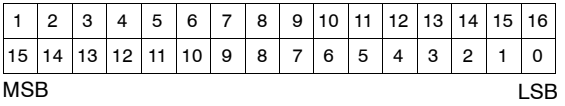
Note: For the IODDT the data type `T_ANA_IN_VWE` is used and the variable `My_Temp` with the address `%CH1.5.10` was defined.

For comparison, the register addressing as used with Concept is added in the last column. As Concept does not support direct addressing of a bit in a word, the bit extraction has to be performed in the user program.

Discrete I/O Bit Numbering

Introduction

The numbering of channels of an I/O module usually starts with 1 and counts up to the maximum number of supported channels. The software however starts numbering with a 0 for the least significant bit in a word (LSB). Additional the Quantum I/O modules have their lowest channel mapped to the most significant bit (MSB).
The following figure shows the mapping of I/O channels related to the bits in a word:.



Word Addressing versus Bit Addressing

Mainly discrete I/O modules can be configured to deliver their I/O data either in word format or in bit format. This can be selected during configuration by selecting either %IW (%MW) or %I (%M). If you need to access a single bit from an I/O module configured to use an I/O word, you can use the syntax %word.bit. The following table gives you the connection between I/O point number and the belonging I/O address in bit and word addressing.
The table shows an 32-point input module in the main rack, slot 4 configured with starting address %I1 or %IW1:

I/O channel	Bit address (flat addressing)	Bit address (topological addressing)	Bit address extracted from word (flat addressing)	Bit address extracted from word (topological addressing)
1	%I1	%I1.4.1[.0]	%IW1.15	%IW1.4.1.1.15
2	%I2	%I1.4.2[.0]	%IW1.14	%IW1.4.1.1.14
3	%I3	%I1.4.3[.0]	%IW1.13	%IW1.4.1.1.13
• • •				
15	%I15	%I1.4.15[.0]	%IW1.1	%IW1.4.1.1.1
16	%I16	%I1.4.16[.0]	%IW1.0	%IW1.4.1.1.0
17	%I17	%I1.4.17[.0]	%IW2.15	%IW1.4.1.2.15
18	%I18	%I1.4.18[.0]	%IW2.14	%IW1.4.1.2.14
• • •				
31	%I31	%I1.4.31[.0]	%IW2.1	%IW1.4.1.2.1
32	%I32	%I1.4.32[.0]	%IW2.0	%IW1.4.1.2.0

Addressing

Flat Addressing

This module requires 6 contiguous, 16-bit input words (%IW), and 6 contiguous, 16-bit output words (%QW).

Topological Addressing

Topological addresses for the 140MS•10100 modules:

Point	I/O Object	Comment
Input 1	%IW[\b.e\]r.m.1.1	Module Status
Input 2	%IW[\b.e\]r.m.1.2	Command Echo
Input 3	%IW[\b.e\]r.m.1.3	Data
• • •		
Input 6	%IW[\b.e\]r.m.1.6	Data
Output 1	%QW[\b.e\]r.m.1.1	Control Register
Output 2	%QW[\b.e\]r.m.1.2	Command Register
Output 3	%QW[\b.e\]r.m.1.3	Data
• • •		
Output 6	%QW[\b.e\]r.m.1.6	Data

Used abbreviations: **b** = bus, **e** = equipment (drop), **r** = rack, **m** = module slot.

Note

The Input/Output words 3 ... 6 are used for data exchange between the module and the CPU, depending on the active command.

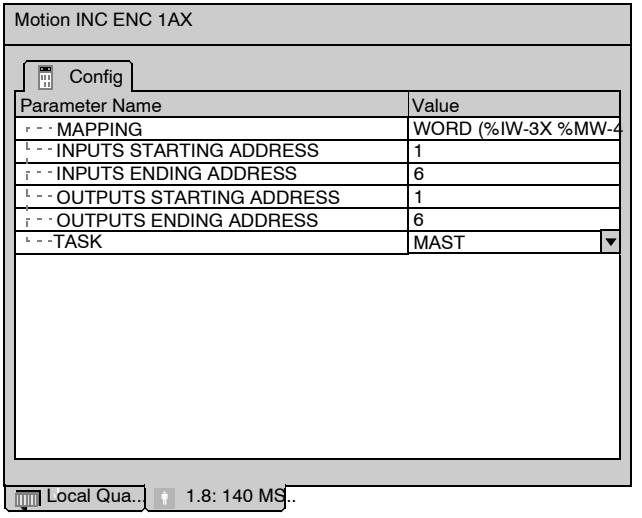
IO Mapping Configuration

7

Parameter Configuration

Parameter and Default values

Parameter Configuration Window



Name	Default Value	Options	Description
Mapping	WORD (%MW-4X)	-	-
Inputs Starting Address	1	-	-
Inputs Ending Address	6	-	-
Outputs Starting Address	1	-	-
Outputs Ending Address	6	-	-
Task (Grayed if module in other than local)	MAST	FAST AUX0, AUX1, AUX2, AUX3	fixed to MAST if module in other than local MAST = Master Task is attached FAST = Fast Task is attached AUX... = Aux Task is attached

Hardware Installation

8

At a Glance

Purpose

This appendix describes the process of mounting and connecting the MSx Modules, as well as adherence to International standards, and types of cabling needed.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Mounting and Connecting the MSx Modules	56
Conforming to European CE Approval Standards	61

Mounting and Connecting the MSx Modules

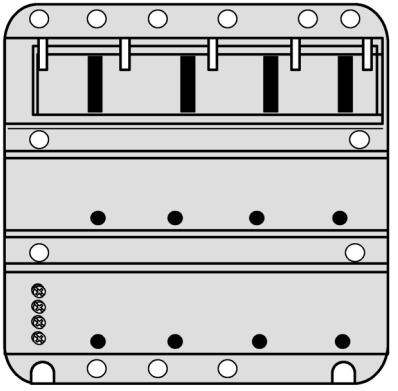
Introduction

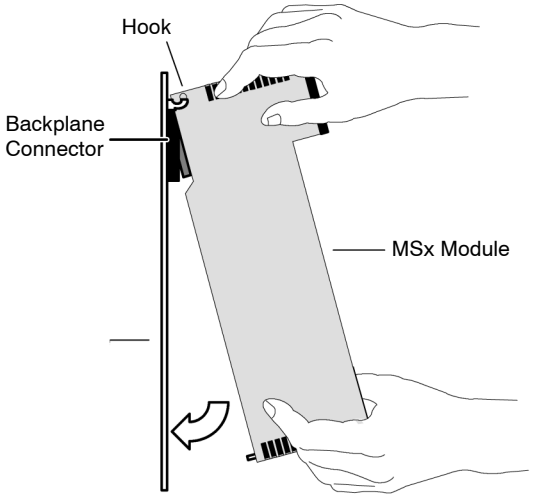
The MSx modules can be inserted into any slot of any backplane and removed under power (hot swapped) without damaging modules or the backplane (Quantum power supply modules must be installed in the first or last slots of the backplane). Refer to the following procedure when mounting modules.

Note: For the required grounding configurations for the single axis motion modules, refer to the Quantum Automation Series Hardware Reference Guide. (Reference No. see *Related Documents, p. 8*).

Working with the Backplane

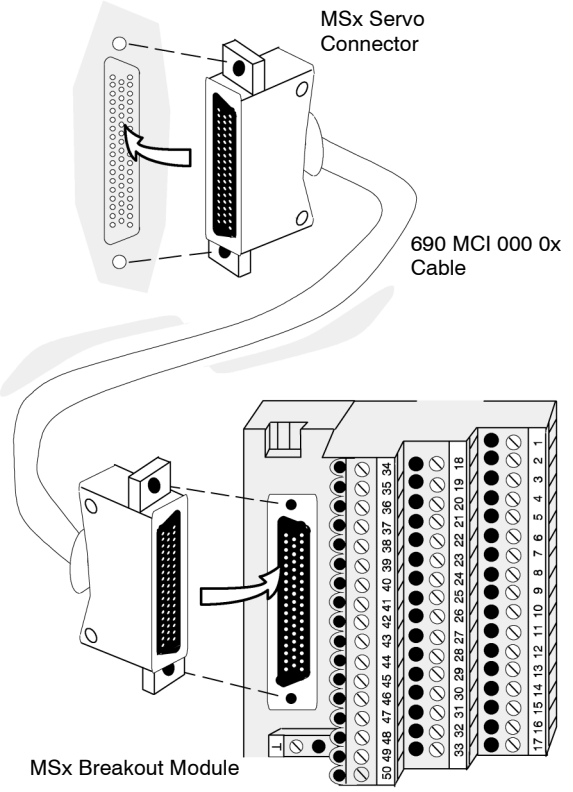
The procedure illustrates the proper handling of the Backplane for the MSx Module:

Step	Action
1	Select a Quantum backplane. 
2	Remove the backplane connector cover(s). Backplanes are designed to mechanically secure and electrically connect all modules used in drops. The backplane contains a passive circuit board which permits modules to communicate with each other and to identify their slot numbers without further switch settings.

Step	Action
3	Mount the MSx at an angle on to the two hooks located near the top of the backplane. The following figure illustrates the actual mounting process, and involves Steps 3 through 5.  Note: To meet vibration/shock specifications, the backplane must be mounted using all specified mounting holes. The backplane is mounted using standard hardware (described below). The recommended length for the mounting screws should be within the following range: 0.24 in (6 mm) - 0.52 in (13 mm). The head height of the screws should not exceed 0.14 in (3.5 mm).
4	Swing the MSx down to make an electrical connection with the backplane I/O bus connector.
5	Tighten the screw at the bottom of the MSx to fasten it to the backplane. (**The maximum tightening torque for these screws is 2-4 in-lbs.**)

Connecting the MSx Modules

The following procedure indicates the proper connection between the MSx Module and the Breakout Module.

Step	Action
1	Once installed, connect the MSx, using a 690 MCI 000 0x breakout cable to the breakout module as follows. Reverse the order of these steps to remove breakout cable. The following is an illustration of the connections between: the MSx Servo Connector; the 690 MCI 000 0x Cable; and the MSx Breakout Module: 
2	As shown in this illustration, line up the connector on the MSx and push the cable firmly into the connector.
3	Once the cable is secured to the connector, tighten the screws onto the connector.
4	Plug the other end of the cable into the breakout module using the same procedure as above.

Step	Action
5	Apply the applicable label (MSB or MSC shown below) to the cabinet or rack as a reference for breakout module connection names. The following figure represents the reference label for the MSB Breakout Module connection names.

Modicon 140 MSB 101 00 Connections

1	CH2 A+	18	24 VDC	34	VEL+
2	CH2 A-	19	24 Com	35	N/C
3	CH2 B+	20	Brake	36	N/C
4	CH2 B-	21	OUT 2	37	VEL-
5	CH2 M+	22	OUT 3	38	Drv Fit
6	CH2 M-	23	CW Lim	39	EN NO
7	CH3 A+	24	CCW Lim	40	EN NC
8	CH3 A-	25	Home	41	EN Com
9	CH3 B+	26	IN 4	42	OTemp+
10	CH3 B-	27	IN 5	43	OTemp-
11	CH3 M+	28	IN 6	44	N/C
12	CH3 M-	29	IN 7	45	N/C
13	N/C	30	HSI	46	
14		31		47	N/C
15	N/C	32	AN Com	48	
16		33		49	N/C
17	N/C				

Step	Action
6	The following is the reference label for the MSC Breakout Module connection names.

Modicon 140 MSC 101 00 Connections

1	CH2 A+	18	24 VDC	34	∅A
2	CH2 A-	19	24 Com	35	∅B
3	CH2 B+	20	Brake	36	∅C
4	CH2 B-	21	OUT 2	37	∅COM
5	CH2 M+	22	OUT 3	38	Drv Fit
6	CH2 M-	23	CW Lim	39	EN NO
7	CH3 A+	24	CCW Lim	40	EN NC
8	CH3 A-	25	Home	41	EN Com
9	CH3 B+	26	IN 4	42	OTemp+
10	CH3 B-	27	IN 5	43	OTemp-
11	CH3 M+	28	IN 6	44	COS+
12	CH3 M-	29	IN 7	45	COS-
13	N/C	30	HSI	46	SIN+
14	N/C	31	AN OUT	47	SIN-
15	N/C	32	AN Com	48	REF+
16	N/C	33	AN IN	49	REF-
17	N/C			50	N/C

Conforming to European CE Approval Standards

General

When a system must be installed according to the European CE* Approval Standards special wiring techniques are required.

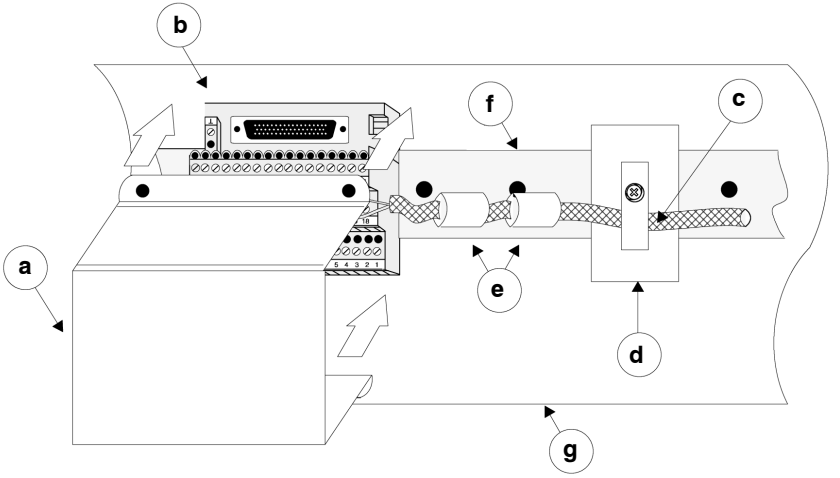
Installing a System

Follow the table below to install a system according to the European CE* Approval Standards:

Step	Action
1	The Breakout Module Cover (**Modicon # 690 MCB 101 00**) must be installed over the Breakout Module after field wiring has been completed in order to shield the termination points from electrostatic discharge.
2	The cover should be placed over the Breakout Module so as to completely cover the terminals and should be screwed down on the same panel as the DIN rail that supports the Breakout Module.
3	If the analog input is used, the twisted shielded pair (**Belden 8451, Alpha 2462**, or equivalent) for the analog input signal should be stripped about 12 inches back from the Breakout Module to expose the shield.
4	The exposed shield should then be attached to the grounded mounting panel using a Grounding Cable Rail (**Modicon # 043509693**).
5	In addition, two ferrite beads (**Steward # 2880686˜200** or equivalent) should be placed over the analog input cable between the grounding cable rail and the Breakout Module.

Special wiring parts

The following figure shows the parts used for special wiring according to the European CE* Approval Standards



a Breakout Module Cover

b Breakout Module

c Twisted shielded pair

d Grounding Cable Rail

e Two ferrite beads

f DIN rail

g Panel

Setting the Rear Panel Switches

9

Overview

Introduction

The following chapter provides information of the rear panel switch settings for the 140 MSx 101 00 module.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Setting the Operating Mode with SW1	64
Setting Modbus Comm Characteristics with SW2	65

Setting the Operating Mode with SW1

SW1 Setting

The SW1 setting determines which device can write to the MSx. The setting is read at power-up and selects either the MMDS or the Quantum PLC to control the operation of the module. This mode selection is a safety feature that prevents you from accidentally issuing commands to the MSx using MMDS while it is being controlled by the Quantum PLC.

The control priority (SW1) is as follows:

1. When only MMDS is attached to the module, it has write privilege regardless of the setting on SW1.
2. When only the Quantum PLC is communicating via the I/O Map to the module, it has write privilege regardless of the setting of SW1.
3. When the Quantum PLC has issued the Set Local Lockout command, it has write privileges regardless of the setting of SW1 and whether or not MMDS is attached.
4. When the Set Local Lockout command is not issued and both the Quantum PLC and MMDS are communicating to the module, the setting of SW1 controls which device has write privilege.

Note: Either device may read—that is, issue a GET command—at any time. However, reading the error log (a system command) is not allowed without write privilege because the log is lost once it has been read. See the Single Axis Software System (SASS) Motion User Guide for details.

Setting Modbus Comm Characteristics with SW2

SW2 Setting

The SW2 setting determines the Modbus communication characteristics. When the module is powered up, SW2 is read. When the switch is open, the default characteristics are used. When the switch is closed then the communication characteristics last saved in the

Once communication characteristics are initialized, they may be changed at any time under software control only if SW2 is in the open position. See the Single Axis Software System (SASS) Motion User Guide for details.

When SW2 is open, these Modbus port default characteristics are used:

- One start bit
- Seven data bits
- One stop bit
- Even parity checking
- 9600 baud

Index

Numerics

140MS•10100
    Addressing, 52
984LL notation, 48

A

Accessories for Connection, 39
Addressing
    140MS•10100, 52
    Example, 50
addressing
    flat, 48
    topological, 49
Addressing Modes, 47

B

Backplane Communications, 19
Breakout Module, 40
Breakout Module Cover, 43
Brushless servo amplifiers
    Lexium 17D, 11

C

Comm Characteristics
    Setting with SW2, 65
Communications Protocol
    Backplane Communications, 19
Configuration
    single axis motion control system, 13
Connecting and Mounting, 56
Connection accessories, 39
Connectors, Front Panel, 27
Cover for Breakout Module, 43

D

DC and brushless drive, 11
Discrete I/O Bit Numbering, 51

E

Electrical Specifications, 34

F

Flash EEPROM, 18
Flash Memory, 18
Front Panel Connectors, 27
Front Panel Indicators for
    140 MSx 101 00, 25

I

I/O wiring block connector
    servo connections, 40
    Single Axis Motion Module, 40
IEC notation, 48
Indicators Front Panel, 25
Introduction, 11

L

Labels, 40
LED Indicators Front Panel, 25

M

MMDS
    On-line and Off-line Development, 20
    RS-232 serial interface, 20
Modbus Connector, 27
Modicon Motion Development Software (MMDS), 30
Motion control
    brushless, 11
    digital, 11
Mounting and Connecting, 56
    Connecting the MSx Modules, 56
    European CE Approval Standards, 61
    Working with the Backplane, 56

N

notation
    984LL, 48
    IEC, 48

O

On-line and Off-line Development
    with MMDS, 20
Operating Mode
    Setting with SW1, 64
Operational Specifications, 31
Overview, 11

P

Presentation
    single axis motion module, 24

Q

Quantum Addressing Modes, 47

R

Rear Panel Switches, 30
    SW1, 64
    SW2, 65
Reference Labels, 40
RS-232 serial interface
    MMDS, 20
RS-232 serial port, 30

S

Serial port RS-232, 30
Servo connections
    I/O wiring block connector, 40
    Single Axis Motion Module, 40
Servo Connector, 27
Setting Modbus Comm Characteristics with SW2, 65
Setting the Operating Mode with SW1, 64
Single axis motion control system
    configuration, 13
Single axis motion module
    Presentation, 24
Single axis motion modules
    140 MSB 101 00, 11
    140 MSC 101 00, 11
Specifications
    electrical, 34
    operational, 31
SW1, Setting the Operating Mode, 64
SW2, Setting Modbus Comm Characteristics, 65
Switch
    SW1, 30, 64
    SW2, 30
    two-position DIP, 30
System Information
    Communications Protocol, 17, 19
    Flash Memory, 17, 18
    MMDS, 17
    On-line and Off-line Development, 17, 20

V

values
reading, 49

W

Wiring according to
European CE Approval Standards, 61